# National energy efficiency

## monitoring report of Trinidad and Tobago

Delena Indar

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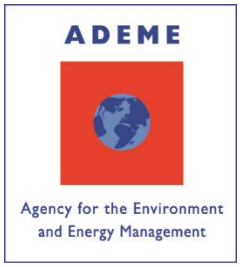
# National energy efficiency monitoring report of Trinidad and Tobago

**Delena Indar**


This document was prepared by officials of the Ministry of Energy and energy Industries in Trinidad and Tobago and the consultant, Delena Indar. Anita Hankey, Senior Planning Officer, and Zahra Cielto-Bowrin, Officer, both of the Ministry of Energy and Energy Industries, were responsible for the executive coordination and technical revision of the document. This document was produced within the framework of the United Nations Development Account project for a Regional Observatory on Sustainable Energy (ROSE), undertaken by the Economic Commission for Latin America and the Caribbean (ECLAC), with the support of the German Agency for International Cooperation (GIZ) and the French Agency for Environment and Energy Management (ADEME). The ECLAC officials responsible for the project were Rubén Contreras Lisperguer of the Natural Resources Division of ECLAC, and Willard Phillips of the ECLAC subregional headquarters for the Caribbean.

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# Summary

Trinidad and Tobago is dependent on its oil and gas sector to support its economy and society. However, given the challenge of climate change, small economies of scale, and increased economic, social and environmental vulnerability, strategies are needed to ensure long-term sustainable development. A key aspect of this is greater levels of energy efficiency, which would allow for energy security in the long term, a reduction in greenhouse gas emissions and increased revenue and cost savings.

Trinidad and Tobago is unique in the sense of low energy prices, high per-capita energy consumption, lack of energy efficiency standards and low awareness regarding energy efficiency. Therefore, understanding trends in the usage of energy is necessary in order to craft appropriate policies and also plays an important role in ensuring the success of such initiatives.

In an effort to correct the deficiency of energy efficiency initiatives in Latin America and the Caribbean, the Economic Commission for Latin America and the Caribbean (ECLAC), with the support of the German Agency for International Cooperation (GIZ) and the French Environment and Energy Management Agency (ADEME), developed a Database of Energy Efficiency Indicators (BIEE) Programme for the Caribbean. An aim of the Programme is to create a database of indicators that measure the performance of energy efficiency policies in participating countries in seven sectors.

Assembly of the database involved the treatment of information at both an aggregate and sectoral level in the sectors of macro-economy, energy, industry, transport, households, services and agriculture for in-depth interpretation of indicators. This document is therefore the first national report containing recent trends in energy efficiency that have emerged from the BIEE Project in the Caribbean, specifically derived from the newly populated database.

In this report, Chapter I introduces the methodology of the BIEE; Chapter II discusses the background to energy efficiency in Trinidad and Tobago. Trends in overall primary and final energy intensities are discussed in Chapter III. Chapters IV to VIII discuss the varying trends in energy and electricity consumption as well as sectoral intensities.

Trends in the data allowed for analysis according to homogenous periods, indicating that in many cases energy intensities had faster growth rates in 2000 – 2008, as compared to 2008 – 2015. In each chapter, sectoral analyses utilize the value-added share to Gross Domestic Product (GDP), energy consumption and where possible, energy consumption by end-use to showcase trends in energy intensity.

The analysis allows for guidance in terms of crafting policy based on statistics, and therefore underscores the need for improved data coverage and subsequent monitoring of policies which have been weak in the past. The database is a much-needed tool that allows for the harmonization of data, but also highlights gaps in data collection especially by end-uses in the residential sector and by branches in industry, which has proven to be the most energy-intensive sector.

# I. Introduction

## A. Background

The Republic of Trinidad and Tobago is a twin island state located in the Southern Caribbean. Covering an area of 5,128 km$^2$, the country has a population of 1.4 million people, with Trinidad being the larger and more populous island. Approximately 95% of the population resides in Trinidad, spread over the country's area of about 4,768km$^2$.

Trinidad and Tobago is classified as a small island developing State given its social, economic and environmental vulnerabilities. However, the country is a very unique case compared to other Caribbean nations, as it is classified as a high-income economy with a robust oil and gas industry. Consequently, the use of renewable resources has been negligible, and given the highly energy-intensive industry, Trinidad and Tobago has the second largest per capita carbon dioxide ($CO_2$) emissions that is about 6 times that of the world average, producing 34 metric tonnes $CO_2$ per capita in 2014 (World Bank, 2014). The petrochemical and heavy industries are responsible for 56% of Trinidad and Tobago's emissions (ACP-MEA, 2013).

Given its large carbon footprint, reduction in emissions is critical for Trinidad and Tobago. Application of the Base de Indicadores de Eficienca Energetica / Energy Efficiency Database (BIEE) programme aligns with policies and plans in Trinidad and Tobago to move towards increased renewable energy generation and energy efficiency. The BIEE Programme was developed by the Economic Commission of Latin America and the Caribbean (ECLAC), with the support of the German Agency for International Cooperation (GIZ) and the French Environment and Energy Management Agency (ADEME) and technical assistance of Enerdata, an energy intelligence and consulting company.

The BIEE Programme has provided a much-needed tool to analyse programmes and activities relating to energy, subsequently allowing for the application of quantitative methodologies to monitor and treat with energy efficiency from both aggregate and sectoral levels in Trinidad and Tobago. This in turn helps in pointing the direction for further development of energy and energy efficiency policies.

The Programme is directly in line with Sustainable Development Goal (SDG) 7 with aims to ensure access to affordable, reliable, sustainable and modern energy for all. But as energy is also linked to many of

the other SDGs, an increase in energy efficiency can further contribute to the achievement of other targets. Energy also plays an important role for other national commitments geared towards national policy targets and meeting targets set according to multilateral environmental agreements (MEAs).

## B. Objectives

BIEE activities were initiated around 2011 and have included at least 19 countries to date. Several countries in Latin America have already participated in the BIEE Programme and in a Caribbean round, four Caribbean countries (Barbados, Guyana, Saint Lucia and Trinidad and Tobago) have joined the Programme to date. The Programme included training workshops on data harmonization and interpretation of implications of the trends of the energy efficiency indicators.

The BIEE programme seeks to strengthen the capacity of energy authorities in Latin America and the Caribbean to improve data reliability to inform energy indicators, monitor and improve energy efficiencies, and enhance evidence-based decision-making on energy efficiency. The Programme encourages a common methodology amongst countries to evaluate national energy efficiency trends and for comparison of aggregate and sectoral trends, both regionally and globally, thereby facilitating regional cooperation as necessary.

The objective of this report is therefore to describe and analyse energy efficiency trends in Trinidad and Tobago on a macro-economic and sectoral level based on data collected through the BIEE Programme.

Given that there was no database for the interpretation of data and monitoring of energy efficiency policies, the newly populated database fulfils another objective of the Programme to improve the monitoring capacity of countries. This tool serves to guide the dialogue for the crafting of national energy policies and to assist national institutions, such as the Ministry of Energy and Energy Industries (MEEI) in meeting national emissions reduction targets and increasing energy efficiency.

## C. Data collection and sources

The MEEI served as the focal point for this project given its role in overall management of the oil, gas and minerals sectors in Trinidad and Tobago. Further, the MEEI houses the National Energy Balance, which is an energy accounting matrix that records the input, output and flow of energy in a country and contained the bulk of aggregate energy consumption data for insertion into the database and further analysis.

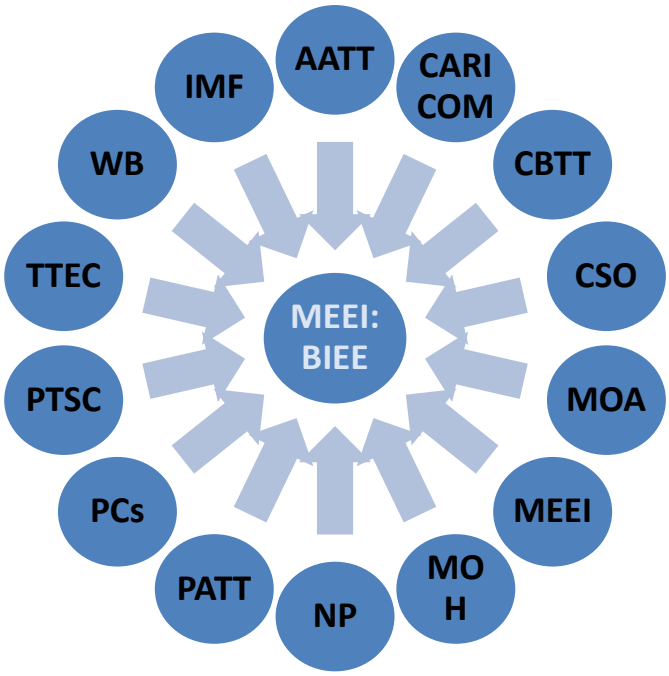
The calculation of energy indicators commenced primarily with the collection of data from 7 sectors, namely macro (macro-economic and general consumption data), energy and power sector, industry, households, services, transport and agriculture, on an annual basis for the period 1997-2016, where possible. A framework, known as the data template, was provided in Excel and listed data parameters which calculated predefined energy efficiency indicators based on the data. The template was adapted to local context and amended as necessary after review and discussion with the technical coordination team.

The data were generally expressed according to the requirements of the data template, often in thousands of tonnes of oil equivalent (ktoe), whereas the national energy balance is expressed in thousands of barrels of oil equivalent (000 BOE). Therefore, all relevant calculations were made according to Society of Petroleum Engineers (SPE) conversions. GDP was expressed as real GDP (2000), and compound annual growth rates were utilized to measure growth over multiple periods. In the template, parameters were manipulated to present data based on local currency for local analysis, but the template also calculates indicators based on purchasing power parities (PPP) which would be the unit of choice for country comparisons. This approach removed the effects from fluctuations in market exchange rates and differences in consumer prices.

In Trinidad and Tobago, the required data are housed amongst several stakeholders and therefore required the input from many agencies, ministries and private entities. Figure 1 showcases the main stakeholders that were involved in the process of data gathering.

Manipulation of data was conducted by the designated national team for Trinidad and Tobago and was guided by consultants through regional training sessions and thorough review of submitted data and information on a periodic basis.

**Diagram 1**
**Data sources**




Source: Author's compilation, 2018.

- AATT- Airport Authority of Trinidad and Tobago;
- CBTT- Central Bank of Trinidad and Tobago
- CSO- Central Statistical Office of Trinidad and Tobago
- IMF- International Monetary Fund
- MEEI- Ministry of Energy & Energy Affairs
- MOA- Ministry of Agriculture
- MOE- Ministry of Education
- MOH- Ministry of Health
- MOWT- Ministry of Works and Transport
- PATT- Port Authority of Trinidad & Tobago
- NP- Trinidad and Tobago National Marketing and Petroleum Co. Ltd.
- NEC- National Energy Corporation of Trinidad and Tobago
- PCs- Private companies such as Tracmac
- PTSC- Public Transport Service Corporation
- TTEC- Trinidad and Tobago Electricity Commission
- WB- World Bank.

Given that the project was implemented simultaneously for different countries, it is the expectation that some of the data will be made available online through a regional data mapper.[1]

The project has therefore succeeded in centralizing an energy-related database, identifying the plethora of data sources and determining critical data that are lacking so that such gaps may be addressed.

In some cases, the required data were available, whereas in others, estimates and elaborations were required in order to to adapt national data to the required format for calculation of indicators. Estimations were necessary as in some cases the data were not readily available, not willingly shared, or not collated in the required format. This resulted in an often involved and very time-consuming process to obtain the data. Moreover, not all the required data were available after 2015 and therefore, the period utilized for analysis was 2000 - 2015.

[1] A data mapper for Latin America already exists at http://www.biee-cepal.enerdata.eu/

# II. The background to energy efficiency

This chapter introduces the legal and regulatory framework and current policies applicable to energy efficiency in Trinidad and Tobago. It also describes current tools and conditions which influence energy supply and consumption.

Energy efficiency refers to a reduction in the energy used for a given service or level of activity. According to the International Energy Agency (IEA), "Energy efficiency is key to ensuring a safe, reliable, affordable and sustainable energy system for the future," and is seen as key to resolving the ""trilemma" of economic development, energy security and climate change." Energy efficiency is important for all countries given the multitude of benefits in the face of increasing energy demand, dwindling reserves, higher resource production costs and concern for the environment. Therefore, energy efficiency can result in potential financial savings both at a societal and macro-economic level, reduce household costs and can be a cost-effective tool for increased competitiveness in businesses. Albeit, the case is somewhat different in Trinidad and Tobago given the subsidized domestic costs of energy, which make investments into efficiency technologies unfeasible and financially unappealing.

However, especially given Trinidad and Tobago's high emissions per capita, energy efficiency could assist in diminishing Trinidad and Tobago's large carbon footprint by reducing emissions. It can further allow for long term energy security, and conservation of depleting reserves taking into account sustainable development principles. Efficiency in usage of resources and application of renewable energies, could also allow for redirected resources to increase exports of crude oil and natural gas in order to increase revenue. Further, energy efficiency can contribute to national development through the introduction of jobs.

General barriers to energy efficiency include lack of education, market and financing barriers, legislative frameworks and in the case of Trinidad and Tobago, highly subsidized energy rates which make pay-backs long and investments unappealing. Trinidad and Tobago's abundant oil and gas resources have afforded its citizens the lowest electricity and fuel rates in the region due to subsidies, but evidence suggests that this has bred a culture of waste.

The insertion of energy efficiency policies has been incorporated to some extent in national planning, mostly through combined mechanisms for renewable energies and energy efficiency. Trinidad and Tobago's National Energy Policy (NEP) 2006, refers to the importance of energy efficiency programmes in order to maximize the use of energy generated and relatedly, reduce $CO_2$ emissions. The NEP proposed the development and implementation of efficiency standards for energy conversion technologies.

The National Climate Change Policy (2011), mentions opportunities for cost savings if cleaner production technologies were utilized, along with the possibility for energy efficiency to provide greater energy security, and coupled with renewable energy, the ability to increase power generation.

The Ministry of Planning and Development is spearheading efforts related to Climate Change, including the ratification of the Paris Climate Change Agreement and is currently preparing Trinidad and Tobago's Third National Communication and second Biennial Update Report for the United Nations Framework Convention on Climate Change (UNFCCC).

Trinidad and Tobago, as signatories to the Paris Agreement, committed to reducing $CO_2$ emissions by 15% from the three highest emitting sectors: power generation, industry and transport, by 2030. These three sectors were found to be the highest emissions contributors following the greenhouse gas inventories which were conducted for the period 1990-2008. Nationally, the Government has set a target of 10% power generation by renewables by 2021.

In transport, focus has been on the utilisation of natural gas with a large number of new buses being Compressed Natural Gas (CNG)-equipped. The Government has attempted to reduce emissions throughout the transportation sector by encouraging the increased use of alternative low-carbon emission fuels, such as CNG, through the removal of Value Added Taxes (VAT) and Motor Vehicle Tax (MVT) on new and used (less than 4 years old) CNG vehicles, and customs duty on conversion kits.

In 2016, one of the revised Foreign Used Car Policy measures, which prohibits the importation of used vehicles older than 4 years, was implemented with immediate effect. This ensures that imported vehicles have newer technologies, and are more fuel efficient than older models. Another major incentive to reduce the emissions in transport, and ensure increased energy efficiency, was implemented in the 2016 National Budget and amended in the 2017 National Budget. This initiative allowed for new and used (less than 4 years old) electric and hybrid vehicles with engines less than 1599cc, to be imported without being subjected to MVT, VAT and Customs Duty.

The Ministry of Energy and Energy Industries, given its role in energy matters, has conducted programmes geared towards increasing energy efficiency, public awareness, and capacity building. Some of these initiatives have been based on the development of frameworks and agreements such as a Framework for the Development of a Renewable Energy Policy in 2011 and have included a mandate that the National Energy Corporation (NEC) embark on a study to develop a framework for an energy efficiency policy in petrochemical plants and large industries in 2011; and a policy-based loan agreement with the Inter-American Development Bank (IDB), which resulted in the development of a Report entitled, "A Unique Approach for Sustainable Energy in Trinidad and Tobago."

Projects have also been conducted and these have included a pilot project with the United Nations Environment Programme (UNEP) which resulted in the development of a tool-kit for Feed in Tariffs (FIT); a renewable energy and energy efficiency project in community centres which was a pilot involving the installation of Solar Photovoltaic (PV) lighting for the exterior of community centres to satisfy exterior lighting needs and promote public sensitization (Phase 2 is being developed); and a Renewable Energy and Energy Efficiency Schools Project which involved the installation of solar photovoltaic (PV) panels and solar stills for water distillation, in several schools across the country.

In order to assist the Ministry of Energy and Energy Industries in its planning agenda, an online register was developed for local entities engaged in renewable energy and energy efficiency businesses/support services and green construction design. An emphasis has also been placed on education though school campaigns, public awareness drives and through the Caribbean Community (CARICOM) Energy Month (CEM), which is observed in November each year and plans activities honouring different themes which raise awareness in energy matters.

In 2017, the Ministry of Energy and Energy Industries invited Expressions of Interest (EOIs) for the development of a Waste to Energy Facility at the Beetham Landfill, which will be followed by the Requests for Proposals (RFP) stage. In 2018, there was a request for Expressions of Interest for utility scale renewable energy projects, also to be followed by a Requests for Proposal.

Unfortunately, certain measures have also stalled, for example, with respect to tax allowances on the costs incurred by companies in the commissioning of energy audits.

The Trinidad and Tobago Electricity Commission (T&TEC) is another institution that has done work related to energy efficiency. Other than internal management systems to cater to system losses and induction of optimal operation and maintenance where possible, on an external front, T&TEC engages in educating the public through promotion and dissemination of saving measures. Fiscal measures include a 25% rebate on electricity bills that are TT$300.00 or less. Whilst this fiscal incentive targets low income households, it provides motivation for low-energy consuming customers to be more energy efficient.

Other fiscal incentives exist for electricity consumers to reduce consumption such as:

- 0% VAT added to solar water heaters, solar PV panels and wind turbines,
- Tax credit of 25 % for solar water heating equipment, up to a maximum of TT$2500.00 in credit.

The BIEE will be particularly useful to monitor the effects of projects and policies and give direction to the further provision of incentives and mechanisms.

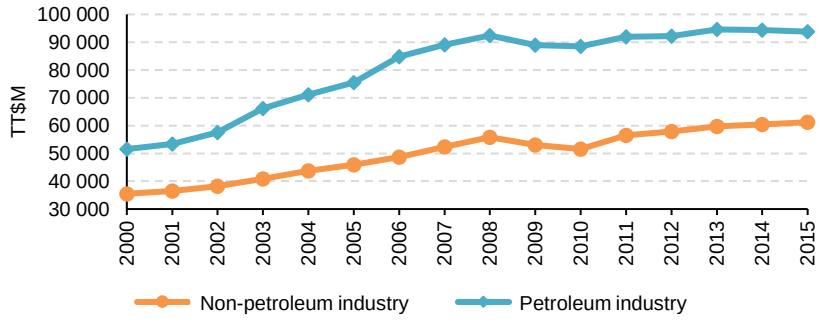
# III. Energy consumption and intensity trends

## A. Economic trends

Trinidad and Tobago witnessed an increase in economic growth followed by decline over the period 2000– 2015. There was at first a period of steady increase in GDP for the first 8 years, with contraction after 2008, consistent with the global economic crisis. The economy however showed some recovery in 2010 with fluctuations until 2016. It can be seen from Figure 1 that the petroleum, or oil and gas sector, has dominated the economy, accounting for approximately 36% of GDP over the period. The sector also accounts for about 80% of exports and 50% of Government revenues.

The Trinidad and Tobago System of National Accounts (TTSNA) allows for the estimation of GDP by petroleum and non-petroleum sectors. In this representation, the share of the sector includes all aspects of the petroleum-related sector, including exploration and production, refining, petrochemicals and service contractors.

**Figure 1**
**Stacked share of petroleum and non-petroleum industry**
*(Real GDP (2000), TT$M)*

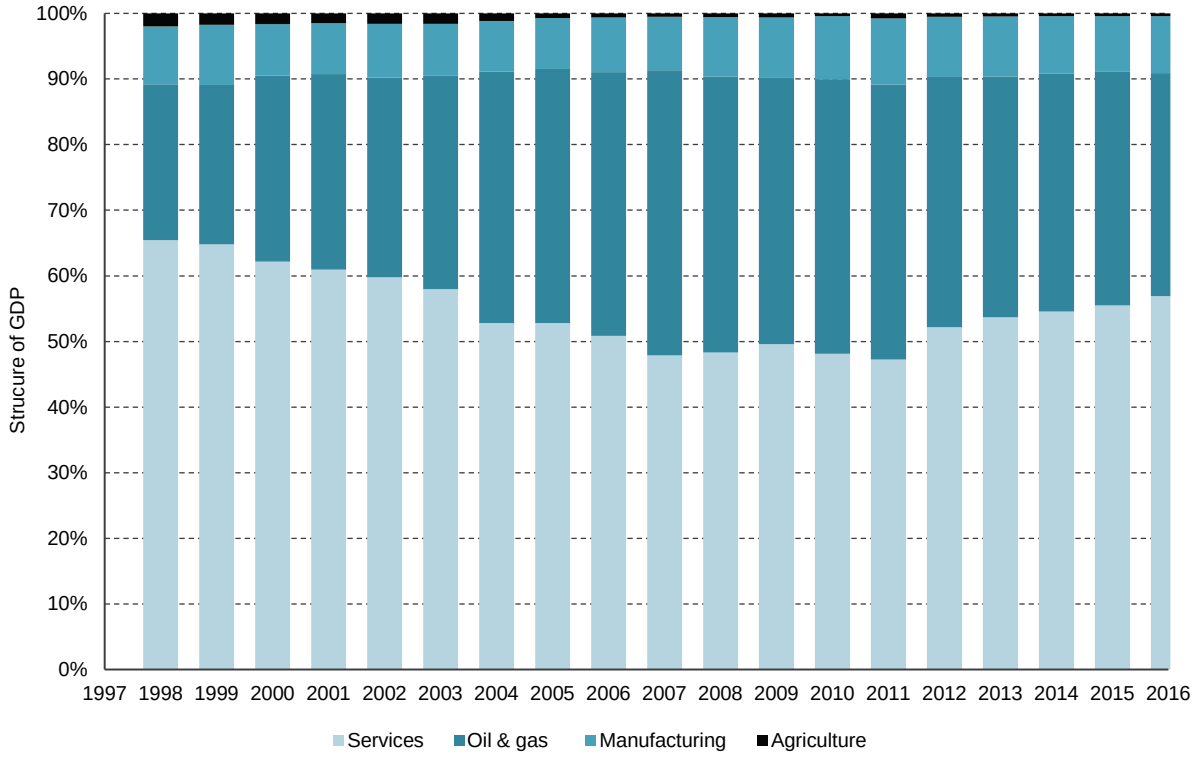



Source: Based on official data from CSO, 2018.

Figure 2 shows the changing GDP structure over time. Agriculture has been on the decline, decreasing from 1.4% share of GDP to 0.4% of GDP in 2000 and 2015 respectively. Manufacturing showed some increase over the time period but especially so up to 2010, after which its value added stabilized. It is the oil and gas sector and services sector that have fluctuated in share the most, with oil and gas changing from a 27% share in 2000 to a maximum of 39% in 2010, after which it again began to shrink to 32% in 2015, and further decreased in 2016. The opposite was true of services which declined from a 56% share to 43%, and then again began increasing to 54% in 2015.

When comparing the two time periods in figure 3, it can be seen that agriculture declined at the same rate over the entire period of analysis; manufacturing stabilized in the second period as compared to growth in the first period; both services and the oil and gas industry increased at a slower rate from around 2008.

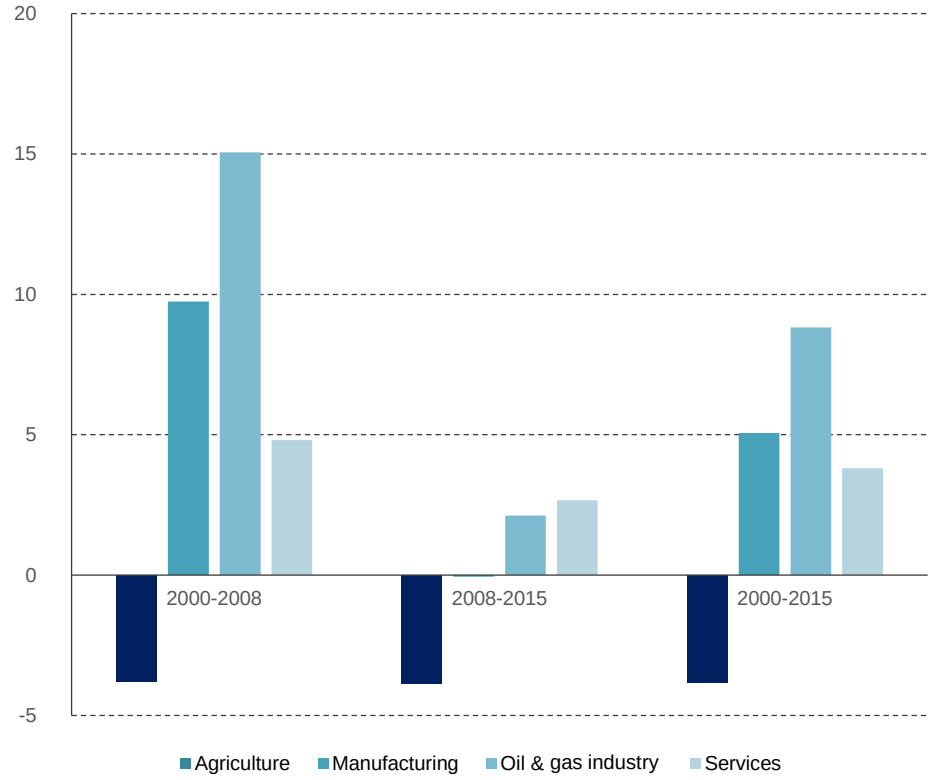
**Figure 2**
**GDP structure, 2000–2015**
*(Percentages)*




Source: Based on official data from CSO, 2018.

In this case, it is to be noted that services in the oil and gas sector have been included in the services sector (contrary to its being included in the petroleum sector). In 2017, the Central Statistical Office (CSO) transitioned its GDP estimates from the Trinidad and Tobago System of National Accounts (TTSNA) to the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 4, which allowed for comparison of primary, secondary and tertiary sectors and in the future, will allow for a standardized sectoral comparison relating to industrial categories.

**Figure 3**
**Growth rate of sectors contributing to GDP**
*(Percentages)*



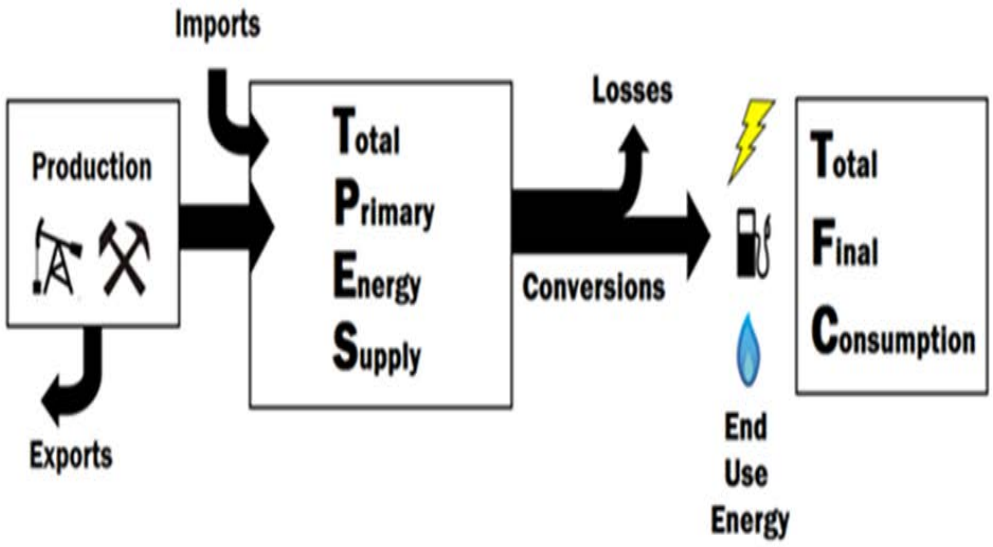

Source: Based on official data from CSO, 2018.

## B. Primary and final energy consumption

Primary energy consumption refers to the total amount of energy that a country has at its disposal. It is also referred to as total energy consumption (TEC) or Total Primary Energy Supply (TPES), and in the case of Trinidad and Tobago, gross internal supply. It includes final energy consumption, final non-energy use consumption, and consumption and losses of the energy sector itself. This definition considers imports and exports so that only energy utilized in the country is considered. In this way, net secondary fuels such as diesel and gas are considered part of primary energy consumption. It should be noted that primary energy consumption may be defined in different ways depending on the country.

Final energy consumption includes the end use consumption of the industrial, commercial, public, residential, agricultural and transportation sectors but not own use of the transformation sector and includes natural gas, biomass, oil products and electricity. Final non-energy consumption includes the use of energy products as raw materials due to their physical or chemical properties, and is not consumed as a fuel.

**Diagram 2**
**Energy flows in a country**

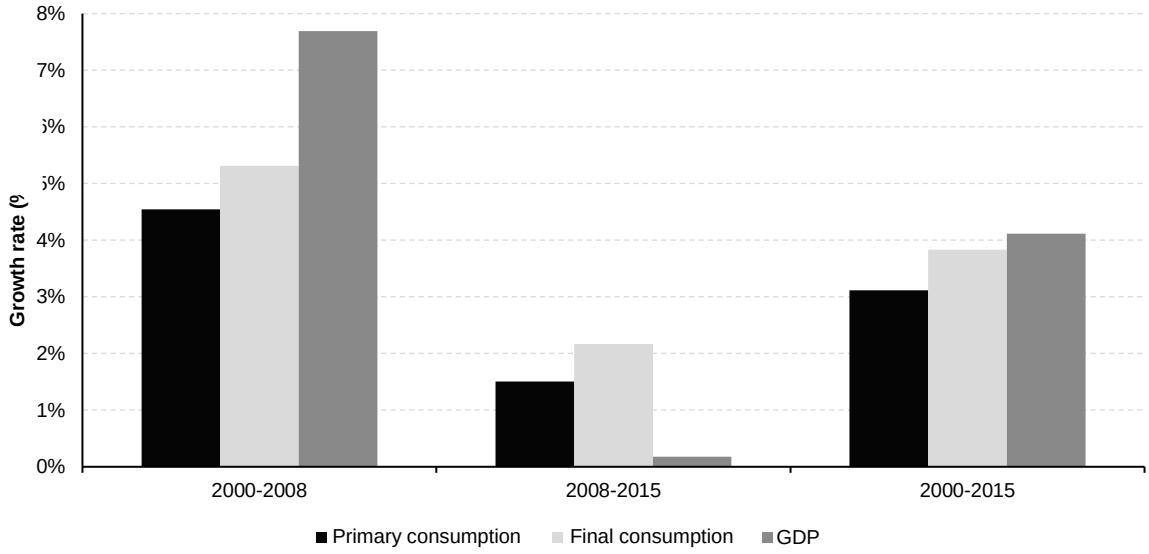



Source: J.M.K.C. Donev et al., (2017). Energy Education - Total primary energy supply [Online].
Available: https://energyeducation.ca/encyclopedia/Total_primary_energy_supply. [Accessed 20/06/18] University of Calgary.

The primary energy consumption in Trinidad and Tobago reached 12,276 ktoe in 2000 and has been increasing by about 4.5% per year on average between 2000 – 2008. This growth was much slower than economic growth. In the second period of analysis, growth of primary consumption slowed to about 1.5% per year between 2008 – 2015, which was faster than economic growth for this period. In 2015, primary energy consumption reached about 19,450 ktoe. In both periods of analysis, final consumption grew faster than primary consumption by about 0.5% per year as seen in Figure 4.

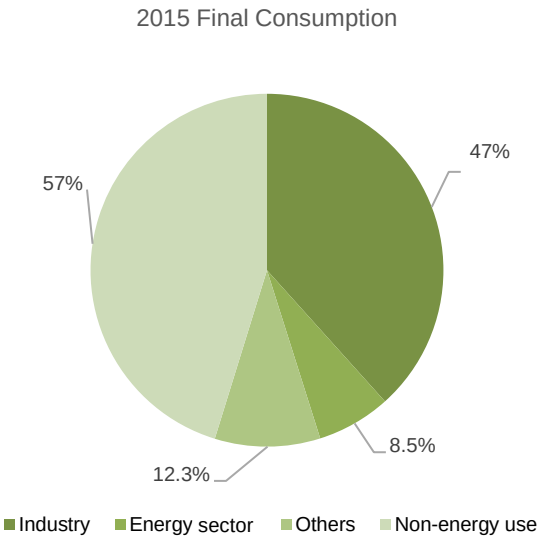
By sector, Trinidad and Tobago is unique in that a large percentage of primary energy (45% in 2015) is utilized by transformations and the non-energy industry. A little over half of that figure (that is, 3,052ktoe) was utilized for final non-energy consumption, whilst the rest was utilized by the energy sector for transformations, own use and losses (see Figure 5). Compared to 2000, less energy was utilized by transformations and non-energy and more in industry and transport by 2015.

**Figure 4**
**Growth in primary and final energy consumption, 2000-2015**
*(Percentage/year)*




Source: Based on official data from CSO and MEEI, 2018.

**Figure 5**
**Primary energy consumption by sector, 2000**
*(Percentages)*

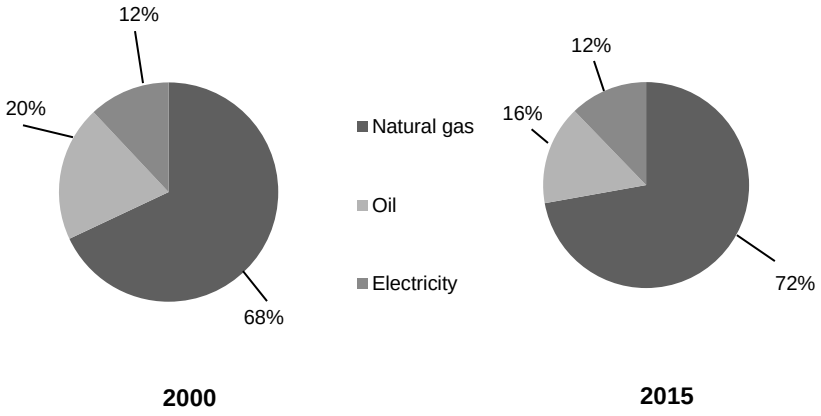



Source: Based on official data from MEEI, 2018.

The final consumption of Trinidad and Tobago was 3,462 ktoe in 2000 and 6,086 ktoe in 2015. The fuel mix mainly consisted of natural gas and oil. In the early 2000s, there was some bagasse in the mix, however, this was a small percentage that is now non-existent. With respect to the fuel mix in final energy consumption in both 2000 and 2015, natural gas was dominant, moving from about a 68% share to 72%, followed by oil which moved from 20% to 16% respectively. Electricity remained constant at a 12% share in both cases, as seen in figure 6.

In the year 2000, industry accounted for the highest share of final energy (78%), followed by transport (16%). The residential and tertiary sectors comprised the remaining 6%. By 2015, the share was similar although consumption of final energy into industry grew by 2 percentile points in 2015, whilst transport declined by 2 points.

**Figure 6**
**Changes in fuel mix in final consumption**
*(Percentages)*




Source: Based on official data from MEEI, 2018.

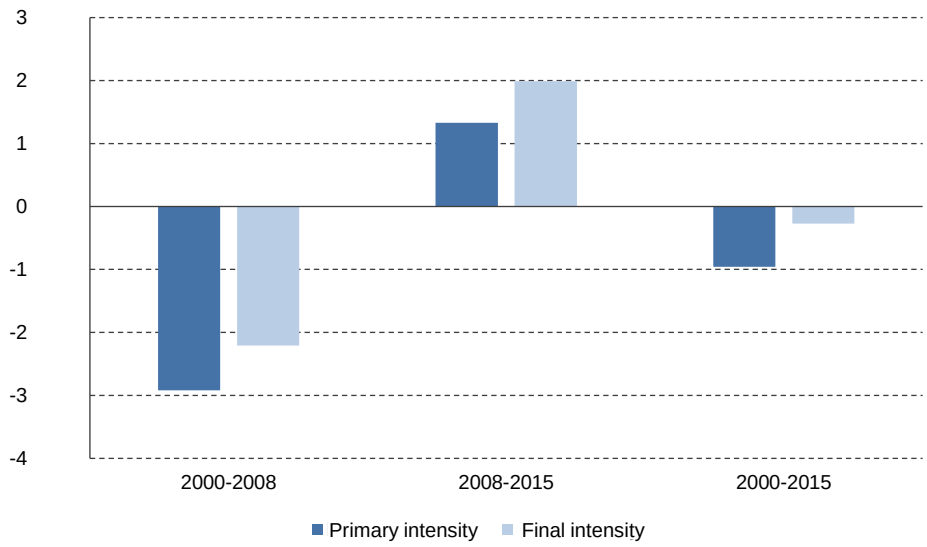
## C. Primary and final energy intensities

One of the major indicators of energy efficiency is energy intensity, which is calculated as energy use per unit of output, expressed in economic terms. Energy intensity is in inverse relation to energy efficiency as energy intensity is reduced when production increases per unit of energy use, or when less energy is used for the same amount of production. Sectoral changes of energy intensity may indicate the use of more energy efficient technology or better organization of production processes and behavioural changes that reduce energy consumption.

Accordingly, one should be cautious when interpreting energy intensity as the indicator, as it can also be influenced by factors that are not linked to energy efficiency, such as economic structures, overall lifestyle changes, power generation mix and transformations.

Figure 7 shows that the primary and final energy intensity decreased over the entire period, but this trend was influenced by decreasing growth rates per year of 3% and 2% respectively during 2000 – 2008. After 2008, when there was the financial crisis, the decline in energy intensity was reversed and led to an increase for 2008 – 2015, with primary and final intensity increasing at 1.3% and 2% per year. Final energy intensity declined less slowly and increased faster than primary intensity in the 2000 – 2008 and 2008 – 2015 time periods respectively. There are several factors at play including behavioural changes of final consumers, and efficiency and losses in the transformation and power sectors.

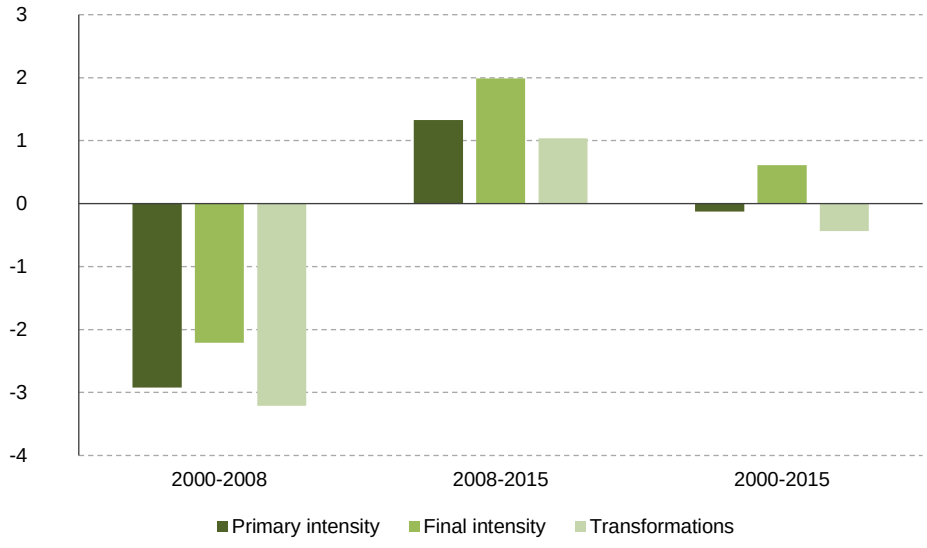
**Figure 7**
**Trend in primary and final energy intensity**
*(Percentage/year)*




Source: Based on official data from MEEI and the BIEE database, 2018.

Trends in primary intensity decomposition show that primary intensity has more intensified patterns than final intensity and that there has been a decrease in the growth rate of transformation intensities for the first period, followed by an increase of about 1% in the second period (Figure 8).

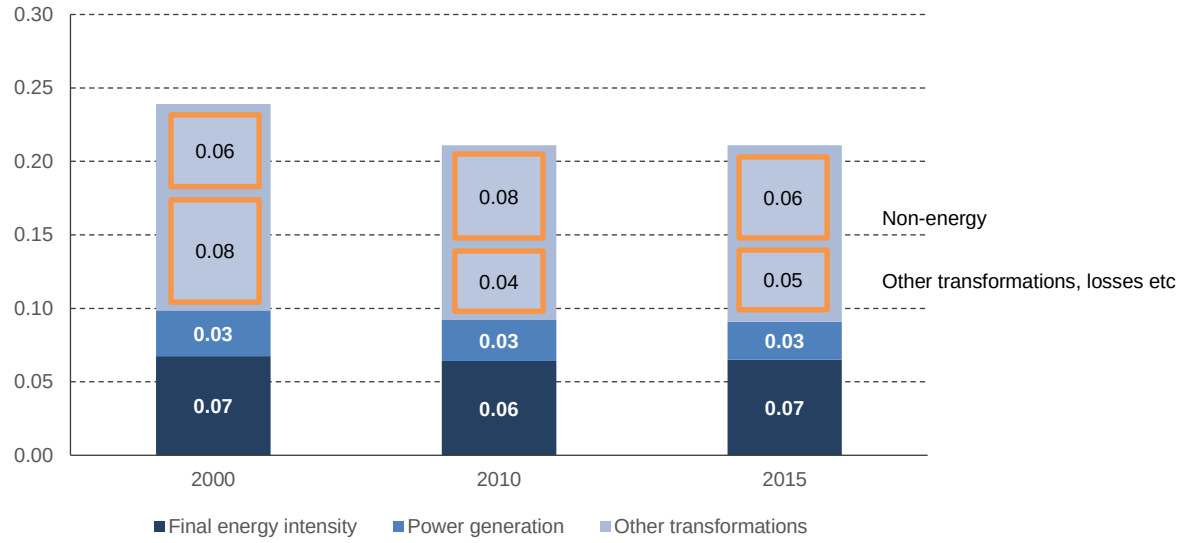
**Figure 8**
**Trends in primary energy intensity decomposition**
*(Percentage/year)*




Source: Based on official data from MEEI and the BIEE database, 2018.

Visualisation of primary intensity variations, as seen in Figure 9, provide further insight into which sectors most influence its energy intensities. Trinidad and Tobago provide an interesting scenario given the large proportion of 'other transformations and losses', which has been adapted to showcase non-energy and the remainder of other transformations and losses. Such sub-sectors can therefore be targeted for energy efficiency programmes.

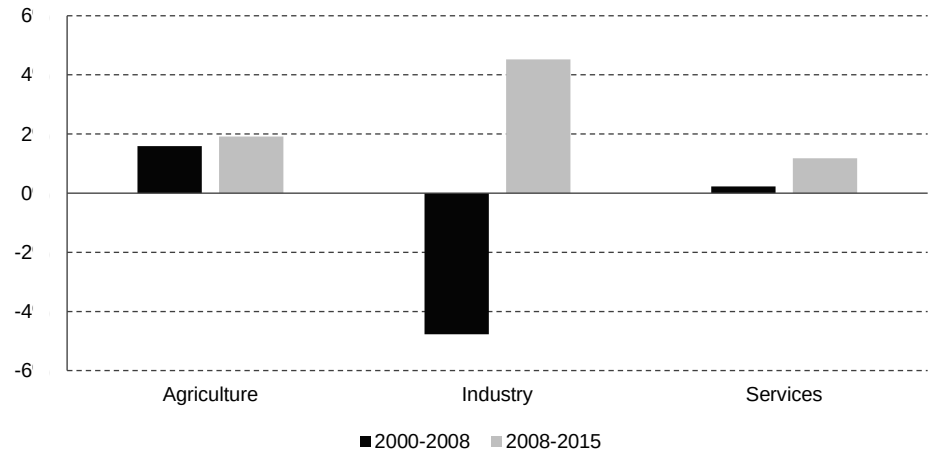
**Figure 9**
**Visualisation of primary intensity variations, 2000–2015**
*(Ktoe/ TTM$ (oo))*




Source: Based on official data from MEEI and the BIEE database, 2018.

Final intensities can also be further analysed through sectoral intensities whereby consumption of energy by sector is compared with value added of GDP, as shown in Figure 10 below. It should be noted that the growth rate of agricultural intensity did not change significantly for the period. It should also be noted that while the trends showcased are based on official data, agricultural consumption data are under-reported.

**Figure 10**
**Variations in sectoral intensities**
*(Percentage/year)*

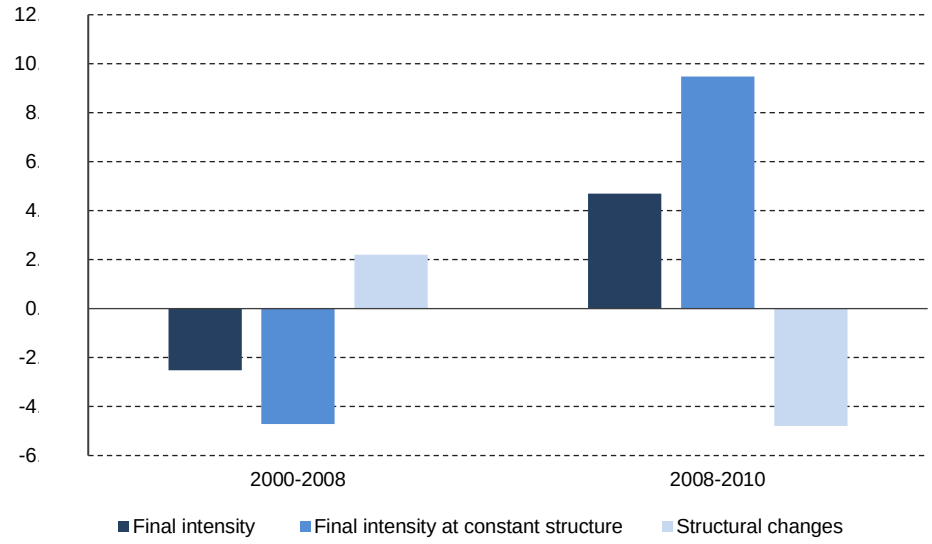



Source: Based on official data from MEEI and the BIEE database, 2018.

Lastly, in order to properly assess the progress of energy efficiency in countries, it is necessary to have knowledge of structural changes, or the contribution of the economic sectors, to the country's GDP. A review of Figure 2, which shows the GDP structure, demonstrated that the contribution of sectors changed over time with respect to services and industry. As all the sectors do not have the same energy intensity, variation in intensity can also be due to contribution of the sectors, as briefly mentioned earlier. Excluding structural changes can be undertaken by calculating final energy intensity at constant structure and the differences between final energy intensity and final energy intensity at constant structure will indicate the influence of structural changes.

According to Figure 11, the change in the contribution of sectors in the GDP contributed to a reduction in final intensity, all things being equal. The structural changes had a larger difference between 2008 – 2010 than 2000 – 2008.

**Figure 11**
**Role of structural changes on final intensity**
*(Percentages)*




Source: Based on official data from MEEI and the BIEE database, 2018.

# IV. Energy efficiency trends in the power generation and energy sector

This chapter describes energy consumption in the transformation/energy sector as well as transmission and distribution losses and losses in energy transformations.

Until recently, there has been no shortage of gas for local consumption for electricity production, and due to the strong petrochemical and hydrocarbon industry, which is highly energy-intensive, power generation does not account for the largest share of consumption. A large share of produced natural gas is used for export of liquefied natural gas (LNG). In relation to primary consumption however, a large share is also utilized by other transformations and the non-energy sector.

Trinidad and Tobago's hydrocarbon sector transitioned from oil to natural gas in the 1990s and currently the country is home to one of the largest natural gas processing facilities in the Western Hemisphere. When natural gas is processed, it is transferred for generation of electricity and to the petrochemical plants for use as a feedstock.

The hub of the country's petrochemical industry activities is located at the Point Lisas Industrial Estate. Trinidad and Tobago is the world's largest exporter of ammonia and the second largest exporter of methanol, according to IHS Global Insight (2013). Policy recommendations already exist for improving energy efficiency in the above, such as budgetary commitments, energy management and regulatory changes.

The BIEE Programme can be manipulated and utilized as a tool to better monitor energy efficiency changes in this sector, as well as in refining.

As it relates to electricity, overall consumption per capita for Trinidad and Tobago was about two times higher than the world average consumption per capita in 2015. According to the Regulated Industries Commission (RIC), there was a 0.7% growth in the average electricity consumption per person within the country in 2015 (RIC, 2017). The share of electricity in final consumption has remained stable at 12% over the entire period of analysis, indicating proportional increases in final consumption and electricity.

The level of industrial electricity consumption plays a large part in the value of this per capita indicator, which is why sectoral analyses are important.

Trinidad and Tobago has a low tariff structure due to subsidies which are a key factor in affecting electricity usage, especially in the commercial and industrial sectors. Power generation is fully thermal and the share of renewables is negligible.

Average thermal efficiency increased from about 29% in the year 2000 to 32% in 2015 given the use of the country's two combined cycle power generation plants. From 2013, all public electricity was produced exclusively from natural gas, when the power station in Tobago started to operate on gas instead of oil. Efficiency would have also increased over 2016 and 2017, given the shutdown of an inefficient plant.

Despite the combined cycle power generation plants and use of natural gas in power generation, the average thermal efficiency over the years has been low in relation to average global figures, and even compared to other Caribbean countries such as Barbados, Saint Lucia and Guyana, which have had closer to 35% average efficiency thresholds.

Upgrading simple cycled plants to combined cycle plants would certainly boost efficiency. An IDB report (Marzolf et al., 2015) had indicated that proposed measures, which consist mainly in substituting simple-cycle gas turbines with combined-cycle plants, could achieve a 45% efficiency improvement by 2020, a significant step forward against the then calculated current efficiency rates of about 27% in 2012.

There are, however, other factors at play and whilst efficiency should theoretically be higher, long-term Power Purchase Agreements (PPA), coupled with low gas prices and Trinidad and Tobago's unique electricity generation, transmission and distribution structure, remove the economic viability of energy efficiency upgrades to existing power plants.

There has also been a focus on transmission and distribution losses though and Trinidad and Tobago, which has one of the lower rates in the region at about 5% in 2015, a decrease from about 7% in the year 2000.

# V. Energy efficiency trends in industry

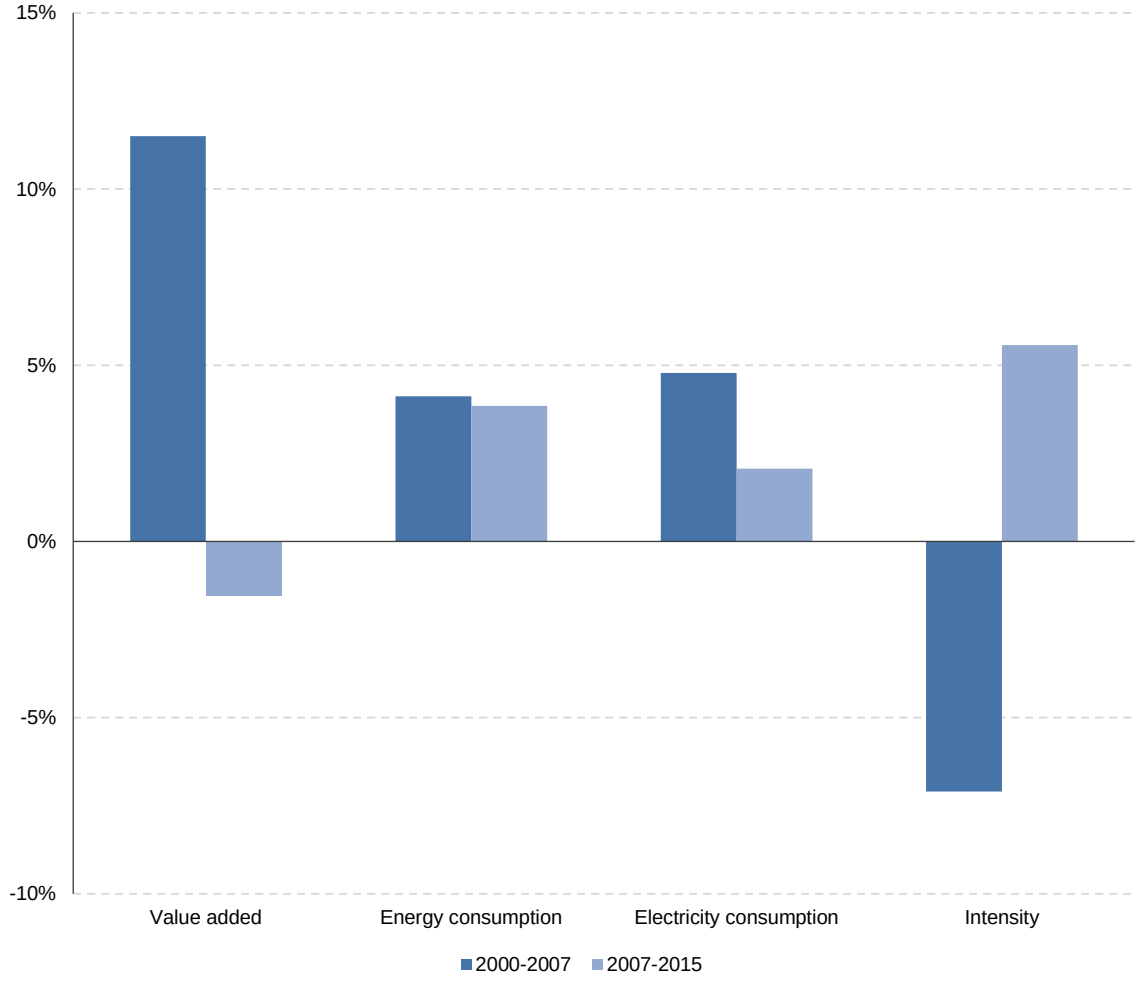
The industry sector in Trinidad and Tobago is energy-intensive, a natural effect of a country rich in hydrocarbons. There is significant manufacturing in Trinidad and Tobago which is a leading producer for food and beverages, cement, iron and steel, chemicals and paper products for both domestic use and export. Construction, mining and quarrying are also considerable, but data on these sectors are limited.

The analysis in this chapter is based mainly on energy balance figures and data on natural gas consumption by sector up to the year 2015. Notably, Trinidad and Tobago's steel manufacturing industry halted in 2016, which would show dramatic changes both in value added and consumption.

The share of industry in final energy consumption is quite large at an average of 80% of the total, and at around 23% of primary energy consumption. The largest share of energy consumed was from natural gas, followed by electricity and oil products.

According to GDP estimates, the value-added share of industry grew per year by about 8% for the first period, a trend which was reversed in the second period. Both energy and electricity had positive growth rates for both periods, with electricity growing at a slower rate in the second period as compared to the first. It can then be said that as value added slowed, so too did electricity consumption; or vice-versa, regarding production. Total energy consumption, largely influenced by natural gas, continued to grow at the same rate. Consequently, the energy intensity of industry, calculated as the ratio between the energy consumption and value added, decreased rapidly during the first period but grew in the second period (Figure 12).

**Figure 12**
**Trends in value added, energy consumption, electricity consumption and sectoral intensity of industry, 2000–2015**
*(Percentage/year)*



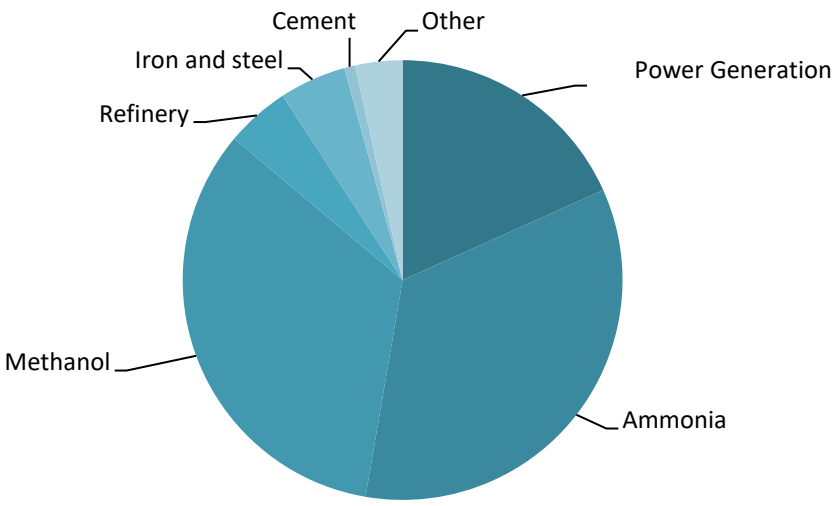

Source: Based on official data from MEEI and the BIEE database, 2018.

It should be noted that energy intensity is influenced by changes in sectoral intensities of the various sub-branches, but also by changes in the contribution of each branch in the value added to GDP, as different branches will naturally be less intensive than others (Lapillonne, 2016).

For thorough analysis on this sector, there needs to be harmonisation in reporting of data with respect to GDP estimates, energy and electricity consumption, which require discussions with stakeholders. Especially considering that the industrial sector is by far the most energy-intensive sector, data gathering and monitoring in this sector should be a priority, especially as in some cases, data will not be difficult to compile once data collection protocols are established.

As an indication of energy usage, the MEEI records natural gas usage by sector; ammonia and methanol utilize the largest share. For the period of analysis, following petrochemical usage, power generation uses the largest share, followed by the iron and steel industry and cement (Figure 13).

**Figure 13**
**Natural gas utilization (excluding LNG), 2015**

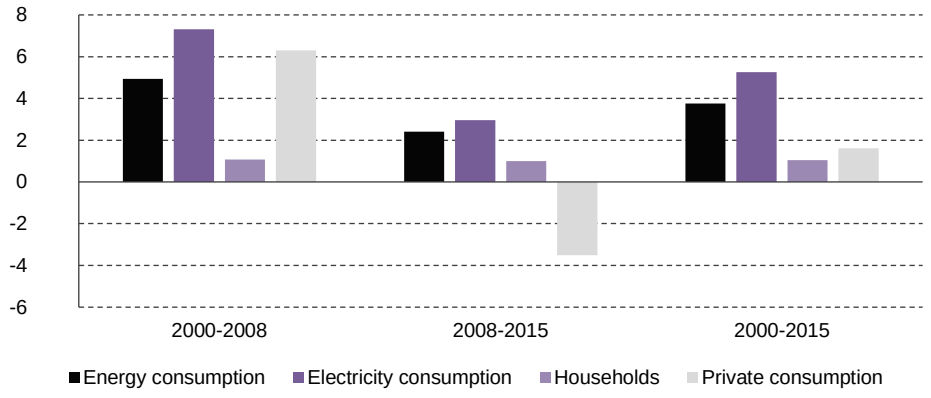



Source: Based on official data from MEEI, 2018.

# VI. Energy efficiency trends in households

According to the 2011 population and housing census of Trinidad and Tobago, the number of households increased from 357,491 to 401,373 in 2000 to 2011 respectively. Following the same trend, it was estimated that number of households increased in total by about 17% over the 2000 to 2015 period. When comparing private household consumption and energy consumption, two periods were selected for comparison, namely 2000 - 2008 and then 2008 - 2015. As shown in Figure 14, private consumption increased during 2000 - 2008, a trend that was reversed during the following period. Both overall energy and electricity consumption grew for the two periods but did so at a slower rate when private consumption was declining. In both cases, electricity consumption grew at a faster rate than final energy, likely due to the penetration of electrical appliances.

**Figure 14**
**Trends in energy consumption, private consumption and households**
*(Percentage/year)*




Source: Based on official data from MEEI and the BIEE database, 2018.

In some cases, energy and electricity consumption also followed a declining trend, but given the relatively low cost of energy and electricity particularly, the resulting trend is a reasonable expectation given the level of decreased household spending. In this regard, the change in trend could be due to behavioural changes as a result of the economic crisis and due in part to changes in availability of household appliances, which in particular, became more available at cheaper rates during the mid-2000s.

Showcasing the specific energy consumption per household, Figure 15 highlights the increase of energy consumption during 2000 – 2015, and the change in trend during certain periods.

**Figure 15**
**Specific energy consumption per household**
*(Toe/household & kWh/household)*

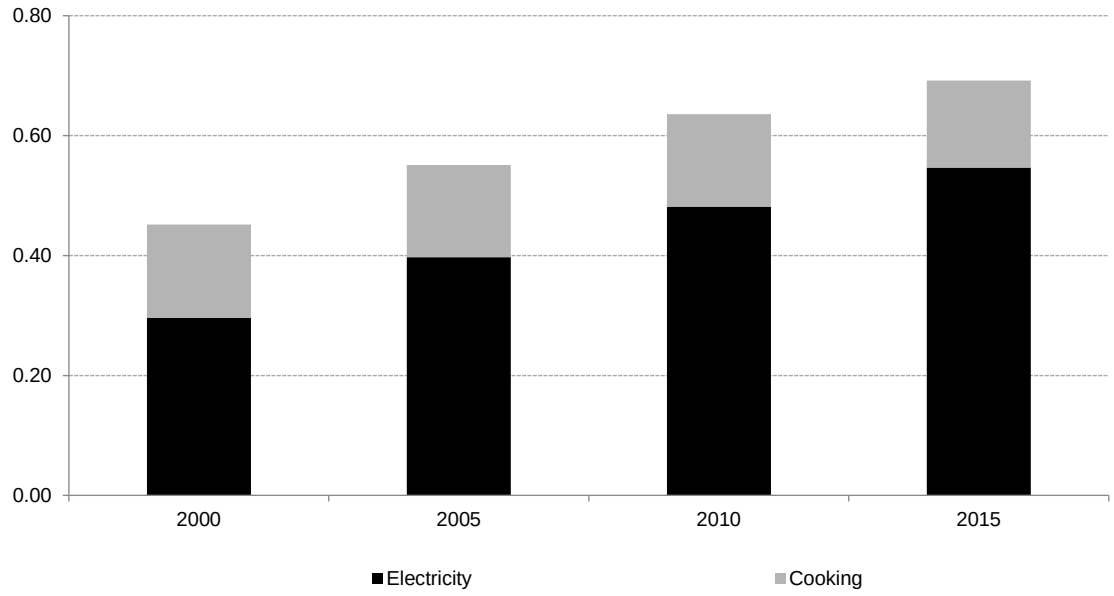

Source: Based on official data from MEEI and the BIEE database, 2018.

In Trinidad and Tobago, the electrification rate is high, approaching almost 99% coverage in 2015. The remaining 1% has proven somewhat difficult to electrify given remote geographical location. Noting that electrification increases unit consumption, there is a somewhat low variation in comparing households versus electrified households. In terms of annual growth, the increase in specific electricity consumption per household during 2000 - 2008 was 7%, whilst per electrified household it was 6%. During 2008 - 2015, the growth in specific electricity consumption per household was 2% per household and 0.5% per electrified household.

As seen in Figure 16, total energy consumption of the residential sector increased over the period, largely due to electricity consumption. Not only has the value of electricity being consumed increased, but so has the share in household energy consumption.

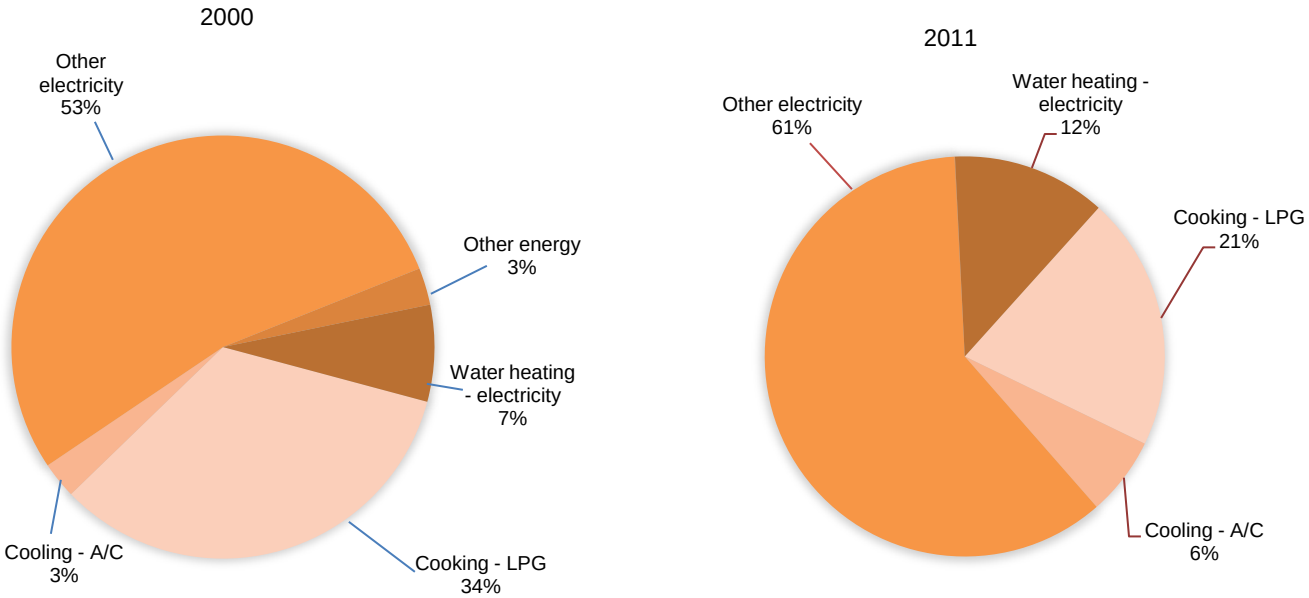
A further breakdown of energy consumption as seen in Figure 17, also reveals that in both 2000 and 2011, electrical appliances and lighting consumed the highest share of final consumption energy at a 61% and 76% share respectively, followed by cooking via LPG, which consumed a 33% and 18% share. Cooling due to air conditioning increased to at least 6%. Other estimates through different methodologies have indicated that cooling due to both air conditioning and fans could be 15% based on the average household (Marzolf et. al., 2015). Notably, given the number of households that had water heaters increased from 9% to 61% between 2000 and 2011, up to 9% from the 61%, and up to 22% from 76% of electrical appliances and lighting could be for water heating.

**Figure 16**
**Household specific energy consumption by main end-use**
*(Toe/household)*




Source: Based on official data from T&TEC, MEEI and the BIEE database, 2018.

**Figure 17**
**Distribution of energy consumption by end-use**
*(Percentages)*

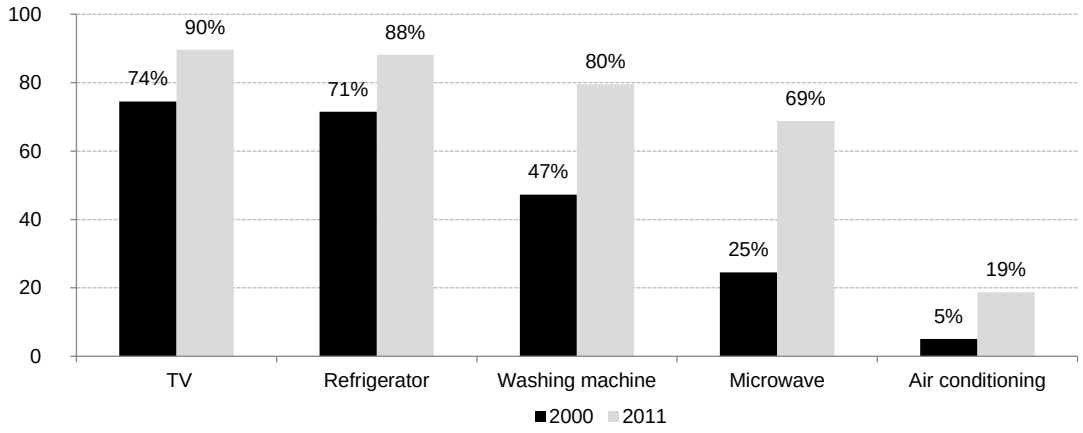



Source: Based on official data from T&TEC, MEEI and the BIEE database, 2018.

Changes on consumption of cooking could be likely that a proportion of cooking was changed to electric as well as changes in cooking patterns.

Regardless, electricity consumption due to electrical appliances and water heating is the highest. About 29% of total electricity consumed is by the residential sector. Therefore, the distribution of how this energy is consumed (by end-use) is particularly important. In this way, policies can be drafted to target which area will have the most effect on increasing energy efficiency. Through the use of census data, the percentile of households with certain types of appliances, as seen in the graph below, can be easily charted to give indications of end-use consumption, and will allow for emerging trends to be analyzed. For instance, it can be seen that microwaves and washing machines have had the highest penetration over the period (Figure 18).

**Figure 18**
**Trends in household ownership of electrical appliances**
*(Percentages)*




Source: Based on official data from CSO, 2018.

Note: Water heaters have been excluded from the graph as the data obtained for water heaters have not been sourced solely from census data.

There is no record as to the number of water heaters by type (tankless water heaters, shower heaters or traditional tank water heaters are the most common). It is this condition that makes consumption by water heaters difficult to estimate, although a range can be comfortably calculated. Notwithstanding, water heaters appear to be a major culprit in terms of energy consumption, averaging in the top three appliances which consume the most kWh on a bi-monthly basis, estimated from average wattage and estimates of hours utilized, according to a T&TEC appliance usage brochure (T&TEC, 2017). Solar water heaters may be a suitable substitution, especially given the penetration rates in Caribbean neighbours, Barbados being a prime example.

The other two appliances that have a relatively heavy consumption are swimming pool filters and air conditioners, both for which ownership is much lower than water heaters; in the case of air conditioners, at least 3 times lower in both 2000 and 2011).

With the consideration of current trends, investment and maintenance costs as well as consumer wants, air conditions would be a useful appliance to monitor, especially given its relatively (specific) high electricity consumption. The same is therefore also applicable to water heaters.

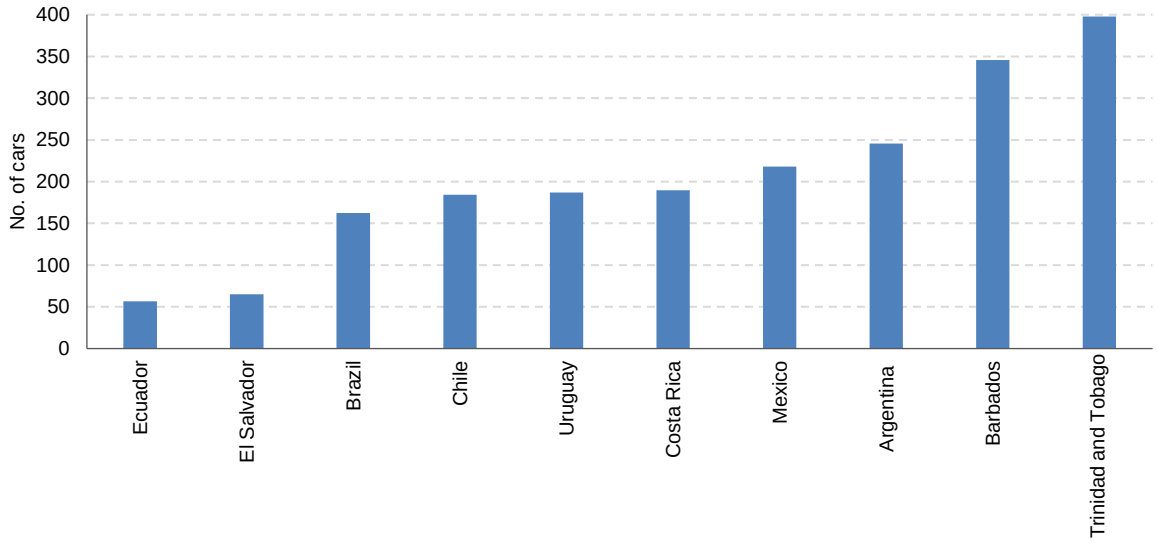
There are programmes in the residential sector geared towards renewable energy technologies, but with less focus on energy efficiency. For success in this area, programmes ought to combine training, efficiency standards and labelling, financial incentives, consideration of market bans of inefficient products and mandatory inclusions of appliances with known higher efficiencies. As has been the topic of many studies, subsidized rates allow for high energy consumption and wastage. However, programmes that focus on specific consumption by appliances and recognized standards of efficiency should be encouraged through fiscal and tax incentives so that there would be some benefit to residential consumers to make the appropriate changes.

Monitoring and data gathering would also benefit the sector by indicationg substitution effects by solar water heaters, penetration of efficient appliances, and number of water heaters by type among others. Once such data are collected, it will allow for full-scale analysis of trends for households. The residential sector is deserving of in-depth analysis from a demographic standpoint. The evolution of the population structure translates to differences in income generation and subsequent spending based on the number of employable personnel per household. This would constitute changes in economic activity and changes in the demand for and end-use of energy. This could therefore drive policy according to future forecasts of energy usage in this sector, especially in ways to engage and motivate consumers to adopt no-cost, durable energy savings behaviours.

# VII. Energy efficiency trends in transport

The transport sector supports all areas of the economy as it allows for movement of both persons and goods. In Trinidad and Tobago, almost 90% of energy consumption for transport is road related, which is not surprising given that there are limited alternatives for easy and reliable transport across the country. Public transportation includes state-owned buses, privately owned mini-buses (known as maxi-taxis) which traverse fixed routes, and privately-owned sedans. Informal taxis are also operated, particularly in rural routes.

**Figure 19**
**Number of cars/1000 inhabitants, 2015**



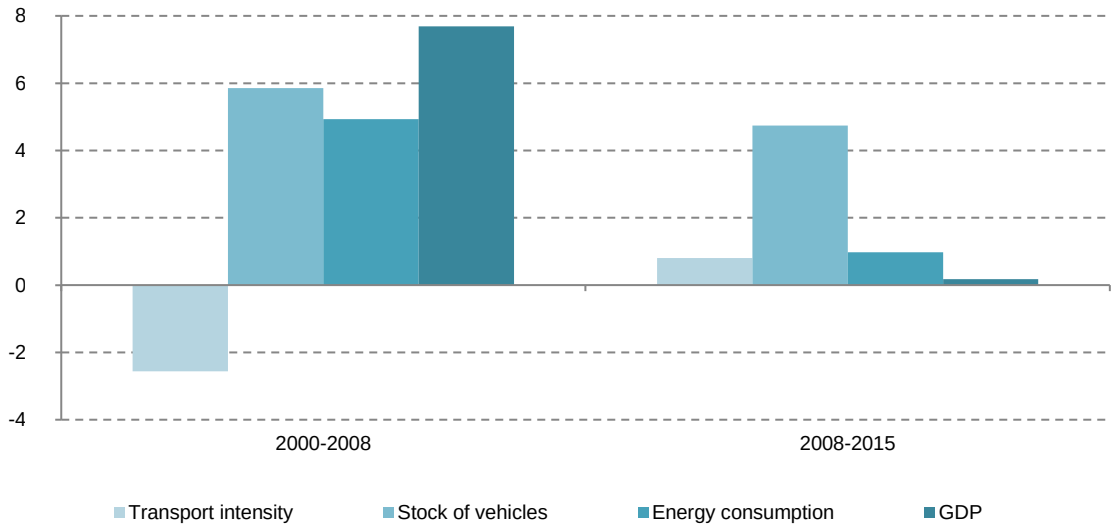

Source: Based on data from the BIEE project compiled by Enerdata, 2018.

In comparing Trinidad and Tobago to some Latin American and Caribbean countries, it was found that Trinidad and Tobago had the highest number of cars per 1000 inhabitants (Figure 19). Coastal transport includes that of an inter-island ferry service from Trinidad to, and from Tobago, as well as between the two main cities of San Fernando and Port of Spain, in Trinidad. Domestic flights are also available between the two islands and its frequency has increased over the years.

Figure 20 below compares GDP, stock of vehicles, energy consumption and transport intensity. The value-added of transport relates to transportation companies, while GDP gives an indication of all sectors which contribute to energy consumption in transport.

One notable annual growth trend for both periods is that the stock of vehicles increased despite the slowed growth rate of GDP during 2008 - 2015. Throughout the period of review, the vehicle pool comprised mainly private vehicles. During 2000 - 2008, energy consumption grew at a slower rate than GDP, but this was not the case for 2008 -2015, as indicated by the decreasing and then increasing trend of transport intensity from one period to the other. The growth of energy consumption, however, was slower in the second period of analysis. Changes in both consumption and intensity could be due to higher efficiency of vehicles, change in energy consumed for vehicles and/or behavioural patterns in energy consumption owing to financial circumstances. Further, one may consider multi-vehicle ownership a factor, as the number of cars would increase but not the distance travelled per household.

**Figure 20**
**Variations in energy consumption (transport), 2000–2015**
*(Percentage/year)*




Source: Based on official data from MEEI and the BIEE database, 2018.

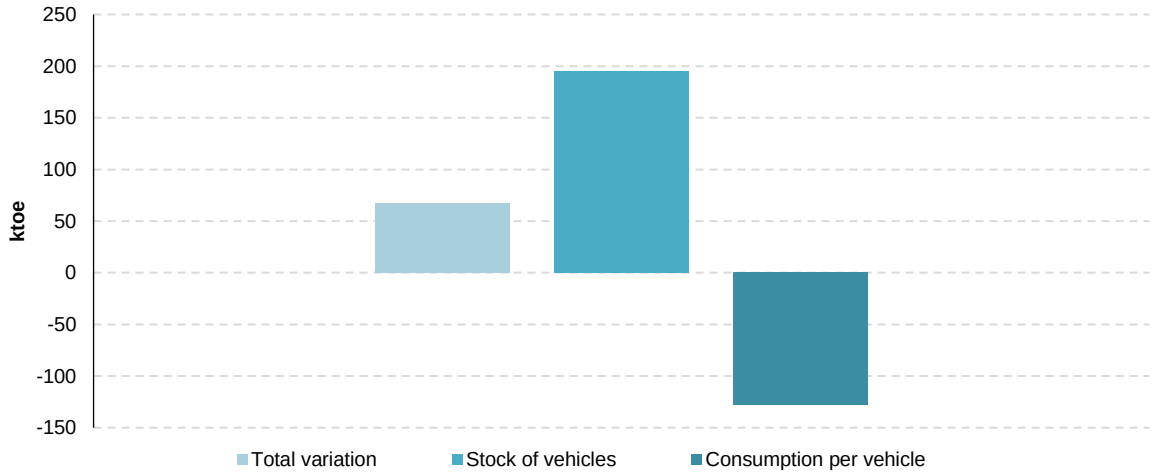
The variation of road consumption can be due to two effects, namely, the increase in the stock of vehicles, which is the activity effect and the variation of the unit consumption per vehicle, which measures efficiency.

The energy intensity of transport in 2015 indicated that Trinidad and Tobago has a transport intensity that is low in comparison to other Caribbean countries. According to Figure 21, increase in efficiency of road transport has been largely offset by the increase in the stock of vehicles, resulting in a 70 ktoe increase in road consumption between 2010 and 2015.

Based on import data, the share of diesel and gasoline vehicles remained somewhat constant over the period of analysis; but analysis of the available data suggests that both the gasoline and diesel consumption of road transport per vehicle have declined by about 2% over the 2001-2014 period.

The difference between energy consumption per vehicle and per car equivalent corresponds to the effect of changes in the composition of vehicle fleet, which allows for better evaluation of energy efficiency improvements regarding per unit consumption. This would adequately allow for interpretation of consumption per vehicle, whether it be through stock changes or energy efficiency. Per car equivalents are calculated with the use of coefficients for different types of vehicles based on consumption and mileage.

**Figure 21**
**Decomposition of road consumption variation, 2010-2015**
*(Ktoe)*




Source: Based on data from the MEEI, CSO, BIEE data and Enerdata, 2018.

Whilst there are benchmarks for such coefficients, the case of Trinidad and Tobago, and other Caribbean nations is peculiar given the large stock of mini-buses. In cases such as these, gas station surveys are needed to calculate gas usage dependant on mileage, type and age of vehicle etc.

For cars, the most relevant indicator for measuring progress with energy efficiency, especially related to technical progress, is the specific fuel consumption in litres per 100 km.

Monitoring in this sector has the potential to be very advanced, since decomposition of the consumption of cars can be done for cars to show the role of different drivers, the growth in population and in car ownership, the reduction in the specific fuel consumption (energy savings) and the change in the distance travelled by cars.

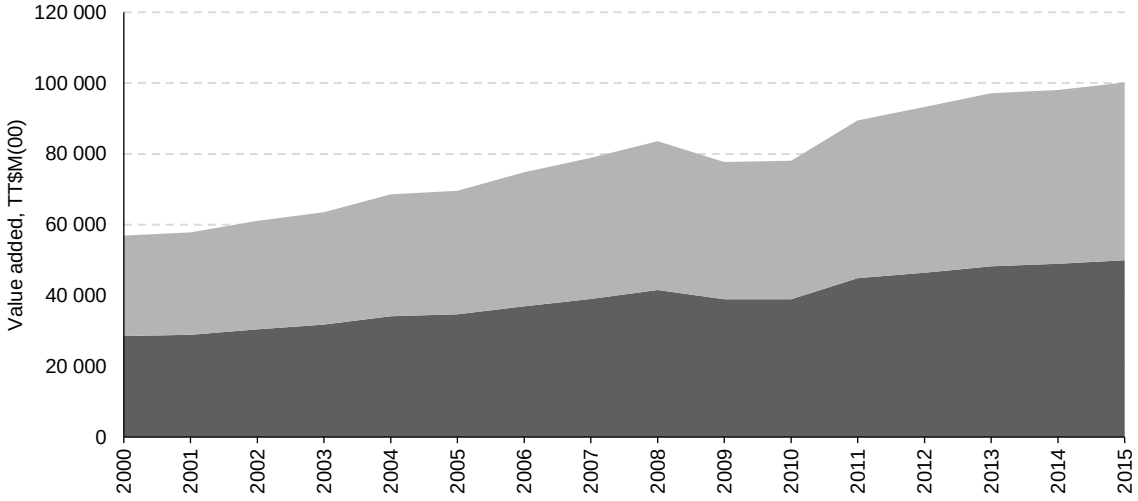
Considering that Trinidad and Tobago has targets for a reduction of the carbon footprint of the transportation sector, programmes in this sector are vital. Yet, lack of reliable transport data is an issue with respect to sales of vehicles by type and fuel type, and such data are needed to properly evaluate energy efficiency. A number of fiscal incentives for compressed natural gas (CNG) with respect to tax credits, duties and VAT as well as training and improvements in refuelling infrastructure have been introduced, however monitoring and evaluation of these policies are needed along with accurate measures of conversions to CNG and imports and sales of CNG vehicles.

# VIII. Energy efficiency trends in services

The tertiary sector is also known as the services sector in that it provides services to the other sectors and to consumers. Trends in this sector can therefore have effects on economic output. According to the template utilized, the services sector was further categorized into public administration and government services, private offices, health and social works, wholesale and retail trade, lodging and catering (inclusive of hotels and restaurants), education, health and public lighting.

Figure 22 below demonstrates that the share of services in GDP has increased over the period and represents about half of GDP. Further, distribution and restaurants have the highest share of value added, followed by finance and banking in the services sector (Figure 23).

**Figure 22**
**Value added of services to GDP, 2000–2015**
*(TT$M(00))*

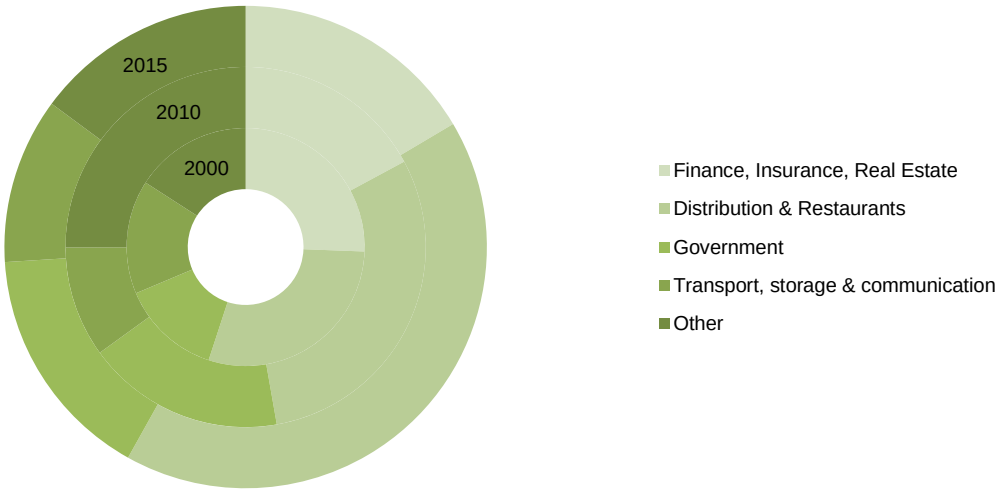



Source: Based on data from the MEEI, CSO, BIEE data, 2018.

The share of services final energy consumption in Trinidad and Tobago is somewhat low, at around 10% but this is because the industry sector is quite energy-intensive (Figure 24). Further, it is likely that energy usage, more so for electricity, is underreported given the manner in which tariff structures are categorized, and that certain services businesses may not have given their current purpose to T&TEC for appropriate classification.

Other analyses have considered the commercial and small industrial sectors together to reduce any errors due to this issue.

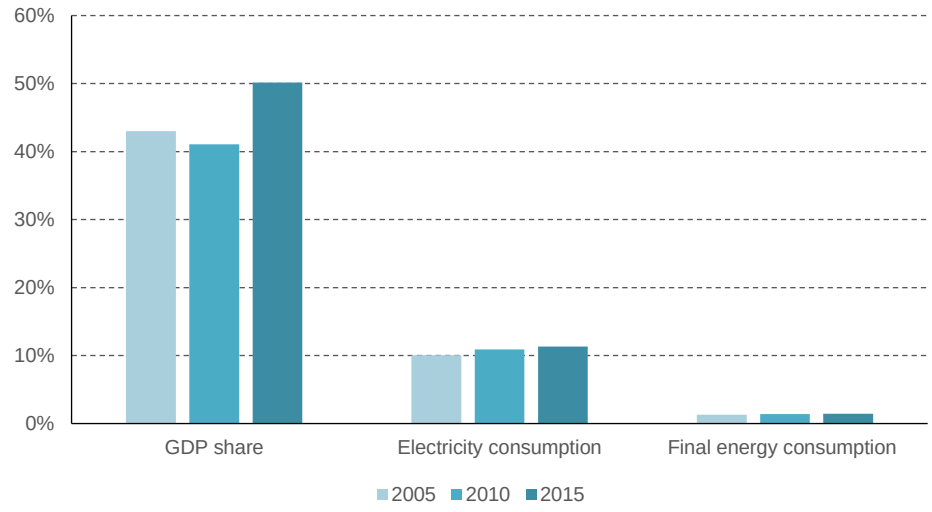
**Figure 23**
**Value added of services to GDP by subsector, 2000, 2010, 2015**
*(Percentages)*




Source: Based on data from the MEEI, CSO, BIEE data, 2018.

Note: Inner circle: 2000; Middle circle: 2010; Outer circle: 2015.

**Figure 24**
**Trends in GDP, final and electricity consumption, 2005, 2010, 2015**
*(Percentage)*

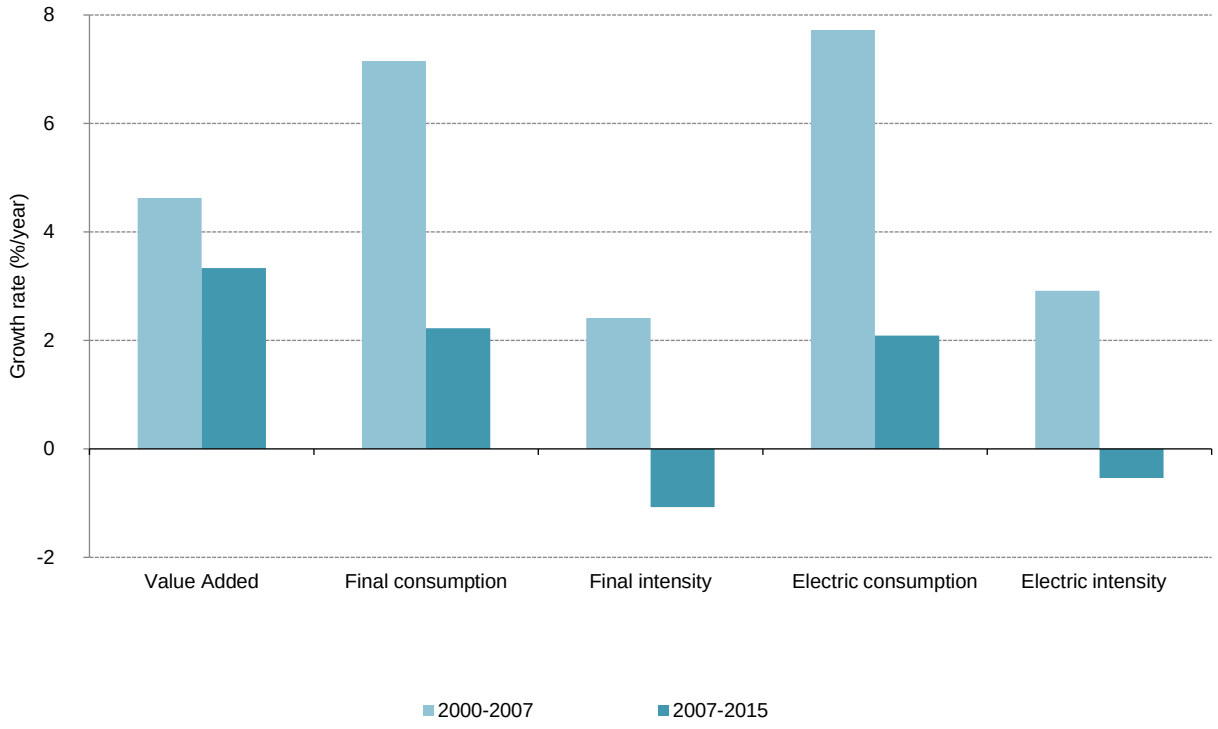



Source: Based on data from the MEEI, CSO and BIEE database, 2018.

In analysing the 15-year period, as of the year 2000, service intensity remained somewhat constant in Trinidad and Tobago. However, analysis by period tells a somewhat different story. The electricity consumption grew slightly more rapidly than energy consumption at almost 8% per year for the first period and slowed greatly to 2% in the second period. In the first period, both final and electricity consumption grew faster than the value added, but less so than value added for the second period. As such, both the final and electricity intensity of services shrank in the second period. In all countries, electricity is the main energy source consumed for services and this is no different in Trinidad and Tobago.

Trends in overall energy consumption and intensity closely follow that of electricity, as seen in Figure 25. In comparing Trinidad and Tobago to some Latin American and Caribbean countries the growth of electricity intensity for the period of 2000 - 2015, appears to be in an average range. Trends in electricity consumption can be explained by the diffusion of office equipment, air conditioning and communication tools. Increase in office equipment would result in increased consumption, but as technology and innovation comes into play in later years, the equipment may be more efficient, thus affecting service intensity in different ways.

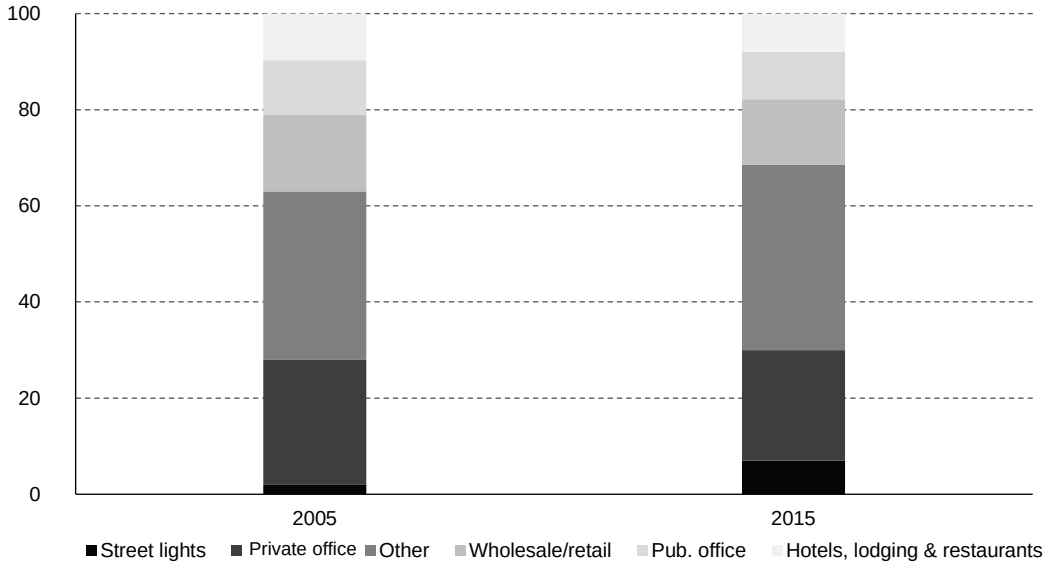
**Figure 25**
**Trends in value added, consumption and intensity, 2000-2015**
*(Percentage/year)*




Source: Based on data from the MEEI, CSO and BIEE database, 2018.

The structure of the share of electricity by sub-sector (Figure 26) has not changed significantly over the period of analysis. Distribution of electricity is consumed mainly by wholesale and public offices which account for over 50% of electricity consumption in the services sector, then followed by public offices. Public lighting per capita saw great increases over the period, with sharp increases especially after 2005. As already recognized, switching to more a more efficient type of lighting would decrease this rate. Considering this, LED street lights were introduced in late 2016.

**Figure 26**
**Distribution of electricity by sub-sector, 2005 and 2015**
*(Percentages)*




Source: BIEE.

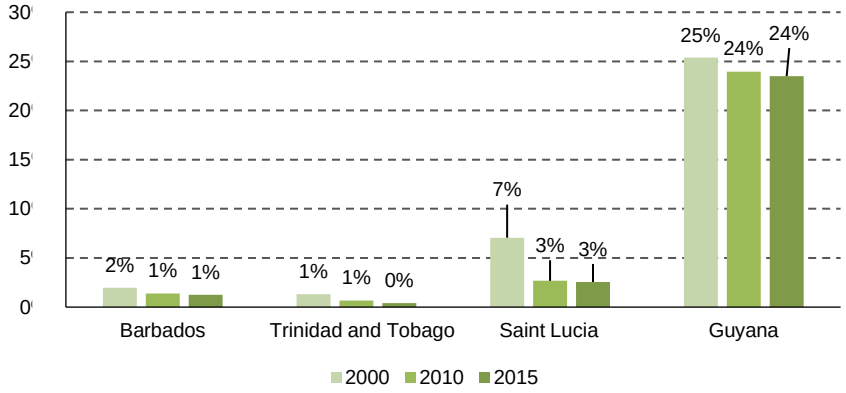
Another indicator to consider is the growth rate of unit consumption per employee which grew from about 0.5% in 2000 to about 3% in 2015, comparable with that of Barbados. When comparing electricity consumption by sub-sectors in relation to the labour force, private offices and wholesale and retail are somewhat similar, both at under 3000kwh/employee. The hotel and restaurant sector appears to have the largest consumption per employee, many times over the two above-mentioned sectors, naturally driven by improved comfort, luxury services and development of information technology and communication tools.

Policies to introduce green certification, installation of more efficient technologies in lighting, cooking and cooling may bode well in this sector, as well as programmes to change behavioural tendencies of usage in such establishments. Notably, for the hotel industry, consumption per bed-night would be quite useful but would require stakeholder input from associations and institutions that gather statistics to craft the collection and monitoring of this data.

# IX. Energy consumption in agriculture

In Trinidad and Tobago, the agricultural sector has maintained a low share of GDP since the oil boom era in the 1970s. As can be seen in Figure 27, the share of agriculture in Trinidad and Tobago's GDP has decreased significantly over the last 16 years, moving from a 1.83% share in the year 2000 to 0.4% share in 2016, with some boost in domestic agriculture in 2010. The value of agriculture for the domestic market is larger than that of export and there have been declines in terms of both national production for local agriculture and for export. In comparison to the four participating countries, Trinidad and Tobago's share of agriculture in GDP was the lowest, noting that Barbados was also low given their heavy dependence on the service sector.

**Figure 27**
**Share of value added of agriculture in GDP**
*(Percentages)*



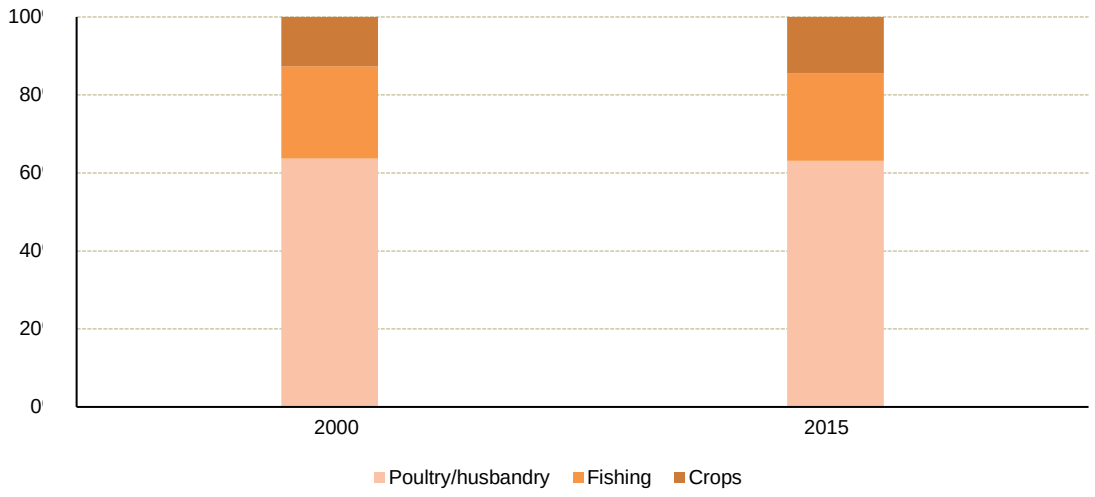

Source: Based on official data from the BIEE database and Enerdata, 2018.

Other than poultry and livestock, local agriculture consists of rice production, root crops, vegetables and fruits. Sugar was the main commercial crop of Trinidad and Tobago but saw a decline in yield over the years. This decline was exacerbated by the eventual closure of a state-owned agro-industrial company, Caroni 1975 Limited in 2003, and the Sugar Manufacturing Company in 2007. Cocoa, coffee and citrus are the main agricultural products for export and whilst there have been fluctuations, there has also been a general decline over the last two decades.

Energy efficiency in agriculture can be defined as a decrease in energy consumption for the production of a unit of agricultural product. Energy inputs are found in every stage of production, from making and applying chemicals to fuelling tractors, harvesting crops, and electricity for animal housing facilities.

In terms of energy usage, oil products such as diesel are the main energy source for tractors, fishing boats, and some pumps. Current energy consumption of the agricultural sector (Figure 28) is likely underreported, given that fuel that feeds into agriculture is often not recorded as use for agricultural purposes. Electricity consumption was on the increase in 2000, but then began to decline after 2010. According to electricity consumption records by type of agriculture, poultry and husbandry utilize the most electricity, followed by fishing and crops. It should be noted that some processing may be included in the following representation due to the manner in which electricity consumption data are presented.

**Figure 28**
**Electricity consumption of agriculture by sub-sector**
*(Percentages)*




Source: Based on official data from T&TE and the BIEE database, 2018.

In agriculture, electricity is used for motorized equipment, for use in animal husbandry farms and in pumps for irrigation, whilst crops are mainly rainfed with the supplementary use of man-made ponds, water channels and irrigation systems. These are especially necessary when rainfall is scarce. In 1997, the area equipped for irrigation was estimated at 3,600 ha. This grew to 7,000 ha in 2004 and is at present estimated at 5 000 ha, indicating the different trends within the time period of study.

Improving energy efficiency of agricultural production contributes directly to the reduction of greenhouse gas (GHG) emissions and means more savings to the famers with respect to electricity, transport and fertilizer costs, and pest management among others.

Energy efficiency in agriculture can introduce better (more efficient, cost effective and environmentally friendly) farming management practices through technological advancements and behavioural change. This is strongly influenced by government policies, and needs to take into account the local environment, including weather patterns, soil conditions and pest status.

There are currently a number of policies and incentives with the aim of increasing domestic food production, improving food security and correcting the institutional and infrastructural shortcomings within the agricultural sector. Such programmes include the provision of access roads, access to water and electricity, rebates on agricultural equipment, and agricultural training. Therefore, energy efficiency targets can be achieved through insertion of strategies for energy efficiency into current programmes, in additional to the implementation of new programmes.

Data gathering and monitoring however, have not been a national focus. In this regard, data for the sector are largely unavailable, aged and of low reliability owing to poor statistical infrastructure to monitor agricultural data across the relevant agencies. This certainly requires attention, and can be addressed by methods to gather official data and make periodic estimates. In this regard, collaboration between agencies could prove to be less costly and provide for accurate data.

# X. Conclusion

The BIEE Programme is likely to be impactful for the data and policy arena in Trinidad and Tobago. Given recent climate change targets, this database fulfils a need by national institutions responsible for energy and its industries in order to ensure success along the path of sustainability for Trinidad and Tobago.

The report highlights the data gathered in the database, along with potential ways in which to interpret the data for a better understanding of aggregate energy efficiency trends, structural changes on consumption and sectoral trends. The database also highlights sectors which need further in-depth analysis, such as industry; and which specific areas need attention such as the thermal efficiency in the power generation. It also shows end-uses in the different sectors, such as the diffusion of appliances in residences and services and underscores the need for regulation and standards with respect to appliances such as water heaters and air conditioners. Further, it showcases the different ways in which sectors can be monitored to properly assess if targets are being achieved, as for instance in the transport sector with respect to CNG vehicles.

The processes of preparing this report included interacting with various energy stakeholders, consultation with experts and consultants, and data gathering from a multitude of sources. As such, the entire process underscored the need for continuity in stakeholder interactions and development of inter-agency and external agency protocols in relation to data.

The BIEE Programme made it possible to identify data gaps, for which rectification is critical to adequately monitor energy efficiency. In the long term, it will facilitate the development of advanced indicators and in the short term, allow for improved monitoring of current programmes. This is necessary for sectors which already have programmes and also for sectors such as agriculture that require programmes.

Finally, an important aspect of the database is that it could allow institutions and policy-makers to actively view the impacts of ongoing and newly implemented policies and programmes over time to enhance evidence-based decision making. This tool could prove to be very useful and critical foe effectively monitoring and remedying the country's energy efficiency issue.

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Trinidad and Tobago is heavily dependent on its oil and gas sector to support its economy and society. However, given the challenge of climate change, small economies of scale, and increased economic, social and environmental vulnerability, strategies are needed to ensure long-term sustainable development. A key aspect to be considered is the greater potential for the implementation of energy efficiency measurements, which would allow for energy security in the long term, a reduction in greenhouse gas emissions and increased revenue and cost savings.

In this report, the methodology of the Energy Efficiency Indicators Database (BIEE) is set out in chapter I and the background to energy efficiency in Trinidad and Tobago is discussed in chapter II. Trends in overall primary and final energy intensities are examined in chapter III. Lastly, chapters IV to VIII analyse the varying trends in energy and electricity consumption, as well as sectoral intensities.

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